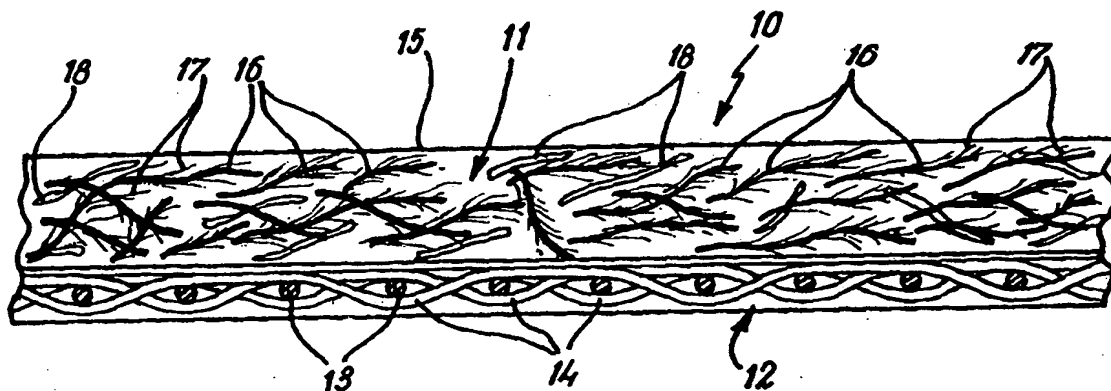


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: PAPERMAKING FABRIC



## (57) Abstract

A papermaking fabric, such as a press felt, has a paper contacting surface (15) provided by a layer (11) which includes a high proportion of fibrillatable fibres (16) to provide a fine structure of the surface (15). The fibrillatable fibres may comprise regenerated cellulose fibres, or be of polypropylene or polyester. Fibrillation of the fibres may be effected before or after installation, by hydroentanglement and/or mechanical pressure.

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## PAPERMAKING FABRIC

This invention relates to the surface structure of a papermaking fabric, such as a press felt, especially to the structure of the paper contacting surface of the fabric.

It is desirable that the paper contacting surface of for example a press felt should be as fine as possible, particularly for lightweight paper grades such as tissues or newsprint, to give a soft, smooth non-marking surface which gives good paper support, it being generally observed that the finer the fibres, the greater the mechanical support for the paper web. However, micro-fibres of less than e.g. 1 denier in fineness cannot be carded on conventional equipment and then formed into a pre-tacked web, as the web is simply too weak to handle. If such a web is then needled to form a batt-on-base type fabric, the web will degenerate into a mass of loose fibres which are easily shed by the felt and enter into the paper sheet.

It is an object of the invention to provide a paper contacting surface structure for a papermaking fabric which is as fine as possible, e.g. in the below 1 denier fineness range, but which avoids the handling and preparation difficulties of masses of very fine fibres.

The invention accordingly provides a papermaking fabric comprising a fibrous surface on at least the paper contacting side of the fabric, the fibrous surface being provided by a layer including fibrillatable fibres.

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The fibrillatable fibres may be fibrillated prior to installation of the fabric on a paper machine, e.g. during manufacture, or may be fibrillated after installation, under the influence of physical conditions on the start-up of the fabric.

The fibrillatable fibres may comprise regenerated cellulose fibres, of relatively large diameter (greater than e.g. 1 denier) which can thus be successfully carded, pre-tacked and needled using conventional press felt processing equipment.

A suitable fibre is that sold under the Trade Mark LYOCELL by Lenzing AG, or TENCEL (Trade Mark) by Courtaulds Limited, which are regenerated cellulose fibres.

Fibrillation of the fibrillatable fibre may be effected by hydroentanglement and/or mechanical pressure, for example by passing the fabric through a press roll nip, or by calendering. The result of fibrillation is to form a microfibre surface consisting of micro filaments still anchored to the relatively coarse parent fibres, which in turn are firmly anchored into the body of the felt.

The fibrillatable fibre may be used to form a pre-tacked web of 90-200 g/m<sup>2</sup> weight, said web consisting entirely of the fibrillating fibre, or comprising a blend e.g. in the range from 60-70% of fibrillatable fibre to 30-40% of other fibres, e.g. nylon, by weight. Said other fibres may be

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standard batt fibres which are in common use, such as nylon 6 or nylon 6.6, or other polyamide fibres.

The felt may be pre-compacted e.g. by waterjet needling (i.e. hydroentanglement), calendering, pressing or ultrasonic treatment. This will induce fibrillation and promote fibre entanglement. Inter-fibre adhesion may be enhanced by standard treatments, or by incorporating relatively low melting point hot-melt or bicomponent fibres into the batt which are subsequently heated to melt them so that they act as a binder when cooled and solidified.

Superabsorbent fibres may also be included to improve water absorbence during start-up (i.e. the initial period of operation following installation of the felt in a paper machine). DYNEEMA (Trade Mark) made by DSM, or SPECTRA (Trade Mark) manufactured by Allied Signal Corporation, or similar abrasion resistant fibres may be added to the fibre blend to improve abrasion resistance.

Fibrillation may in some cases be carried out on the paper machine during start-up, as an alternative to pre-fibrillation during manufacture of the felt. The fibrillatable fibres may be designed so that the fibrils are gradually released from the felt due to the action of high-pressure felt cleaning showers, thereby increasing the openness of the felt structure and countering the tendency for felts to become clogged up.

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In place of cellulosic fibres, the fibrillatable fibres may be of a hydrophobic crystalline polymer such as polypropylene, or a polyester such as PET.

A preferred embodiment of the invention will now be described by way of example, with reference to the accompanying drawing, which is a diagrammatic cross-section of a papermaking fabric according to the invention.

The drawing shows a press felt 10, comprised in its simplest form of a fibrous batt 11, supported on a woven substrate or support cloth 12. Cloth 12 is in known manner comprised of cross-machine direction yarns 13, with machine direction yarns 14 interwoven therewith. In practice a multilayer construction may be adopted incorporating for example one or more perforated membranes, woven or nonwoven textile layers, and possible further fibrous batt layers.

The fibrous batt 11 has a paper contacting surface 15, and the batt 11 is comprised of a mass of fibrillatable fibres 16, shown here to be fibrillated with random fine fibrils 17 extending from the parent fibres 16, to which they are in the main still attached. The batt 11 may also contain non-fibrillatable fibres 18 such as standard batt staple fibres, e.g. nylon 6 or 6.6.

The fibrillatable fibres 16 are of LYOCELL (Trade Mark) which is a

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regenerated cellulose fibre. The fibrillation has been carried out in the process of manufacture of the felt by subjecting the batt to waterjet needling, which causes hydroentanglement, thus not only fibrillating the fibres 16, but forming the batt into a coherent layer in the same way as mechanical needling.

The blend of batt fibres comprises in the preferred embodiment 75% by weight of the fibrillatable fibres 16, and 25% by weight of the non-fibrillatable nylon fibres. The fibrillated mass produces a micro-fine fibrous surface at surface 15 with fibres predominantly less than 1 denier. Such a micro-fine paper contacting surface provides advantageous characteristics, particularly for lightweight paper grades, such as tissues or newsprint, in high speed machines such as improved (i.e. accelerated) start-up speed, greater drying efficiency, felt surface smoothness and a non-marking surface which gives good paper sheet support.

The mass of fibres however, as the parent fibres 16 are greater than 1 denier, can be manipulated by carding, needling and pre-tacking in a way that very fine fibres can not. The main bodies of the parent fibres remain even after fibrillation so that the batt remains capable of being manipulated.

The batt web may be from 90-200 g/m<sup>2</sup> in weight, and the blend of fibrillatable to non-fibrillatable fibres may range from 25%-75% of fibrillatable fibres to 75%-25% non-fibrillatable fibres. The non-fibrillatable

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fibres may comprise not only standard staple fibres such as the nylons mentioned, but also low melting point hot-melt or bicomponent yarns which can be heated to melt them to act as a binder when cooled and resolidified. Superabsorbent fibres can be included to improve water absorbence during start-up, and abrasion resistant fibres such as DYNEEMA (Trade Mark) or SPECTRA (Trade Mark) may also be included.

Fibrillation, or further fibrillation, may take place on the paper machine after installation of the felt during start-up. The fibrillatable fibres may be designed so that fibrils are gradually released due to action by high-pressure felt cleaning showers, increasing the openness of the felt structure and thereby countering the tendency of felts to become clogged up.

LYOCELL (Trade Mark) is particularly preferred as the fibrillatable fibre due to its high moisture regain at a very fast absorption rate, especially compared to thermoplastic (e.g. nylon) fibres. This further improves start-up and reduces rewetting of the paper web. It is also a biodegradable material, being made from wood cellulose and water, and is relatively strong and more resistant to oxidising agents than conventional cellulosic fibres.

An alternative fibrillating fibre material is a hydrophobic crystalline polymer such as polypropylene or polyester, (e.g. PET) since mechanical pressure in the press nip in a paper machine will force water through the micro-fine surface which acts to impede the flow of water back to the



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sheet, thereby preventing rewetting.

Although particularly described in relation to a press felt, the invention is applicable to other forms of papermachine clothing, such as forming wires, dryer fabrics and on any use where a fine non-marking surface is desirable.

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**CLAIMS**

1. A papermaking fabric comprising a fibrous surface on at least the paper contacting side of the fabric, the fibrous surface being provided by a layer of fibrillatable fibres.
2. A papermaking fabric according to claim 1, wherein the fibrillatable fibres comprise regenerated cellulose fibres which are of sufficiently large denier to be successfully carded, pre-tacked, and needled.
3. A papermaking fabric according to claim 1 or 2 wherein the said fibrillatable fibres are fibrillated prior to installation of the fabric on a papermachine.
4. A papermaking fabric according to claim 1 or 2 wherein the fibrillatable fibres are fibrillated after installation of the fabric on a papermachine.
5. A papermaking fabric according to claim 3 or 4 wherein fibrillation of the fibrillatable fibres is effected by mechanical pressure.
7. A papermaking fabric according to claim 6 wherein fibrillation is effected by passing the fabric through a press-roll nip.
8. A papermaking fabric according to claim 6 wherein fibrillation is effected by calendering the fabric.
9. A papermaking fabric according to any preceding claim wherein the fibrillatable fibre forms at least part of a pre-tacked web of 90-200 gm/m<sup>2</sup>

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weight, and comprises from 60-70% of fibrillatable fibres to 30-40% of other fibres, by weight.

10. A papermaking fabric according to any preceding claim including relatively low melting point hot-melt, or bi-component fibres, said fibres being subsequently heated to melt them so that they act as a binder when cooled and resolidified.

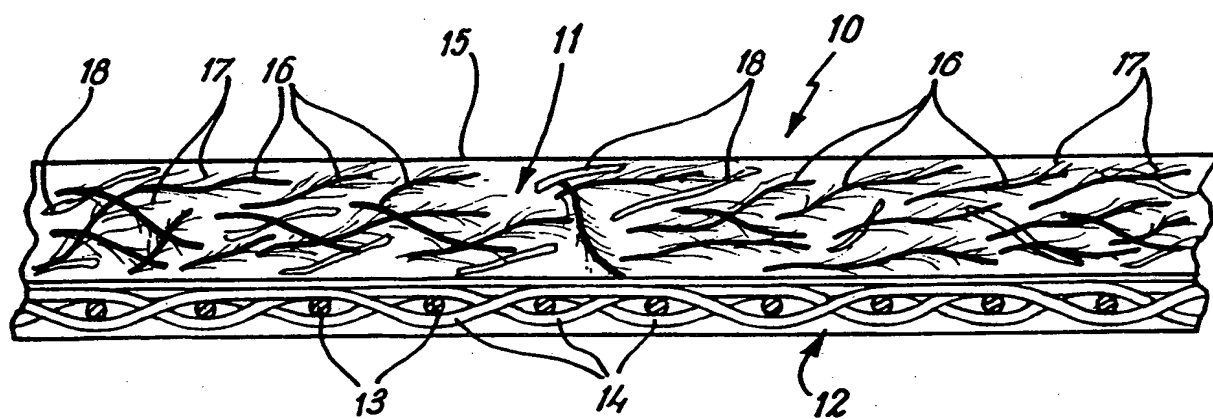
11. A papermaking fabric according to my preceding claim including superabsorbent fibres to improve water absorbence during start-up.

12. A papermaking fabric according to any preceding claim including abrasion resistant fibres.

13. A papermaking fabric wherein the fibrillatable fibres are designed so that fibrils are gradually released from the felt, due to the action of high-pressure felt cleaning shown.

14. A paper making fabric according to claim 1 wherein the fibrillatable fibres comprise a hydrophobic crystalline polymer.

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/03726

A. CLASSIFICATION OF SUBJECT MATTER  
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According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 107 367 A (FEKETE EUGENE ZOLTAN) 15 August 1978 see abstract; figures see column 2, line 17 - line 21 ----	1
A	US 3 392 079 A (FEKETE EUGENE Z) 9 July 1968 see column 7, line 3 - line 65; figures 5-7 ----	1
A	US 5 316 833 A (DAVIS ROBERT B ET AL) 31 May 1994 see column 1, line 65 - column 2, line 2 -----	1

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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